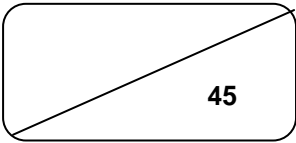


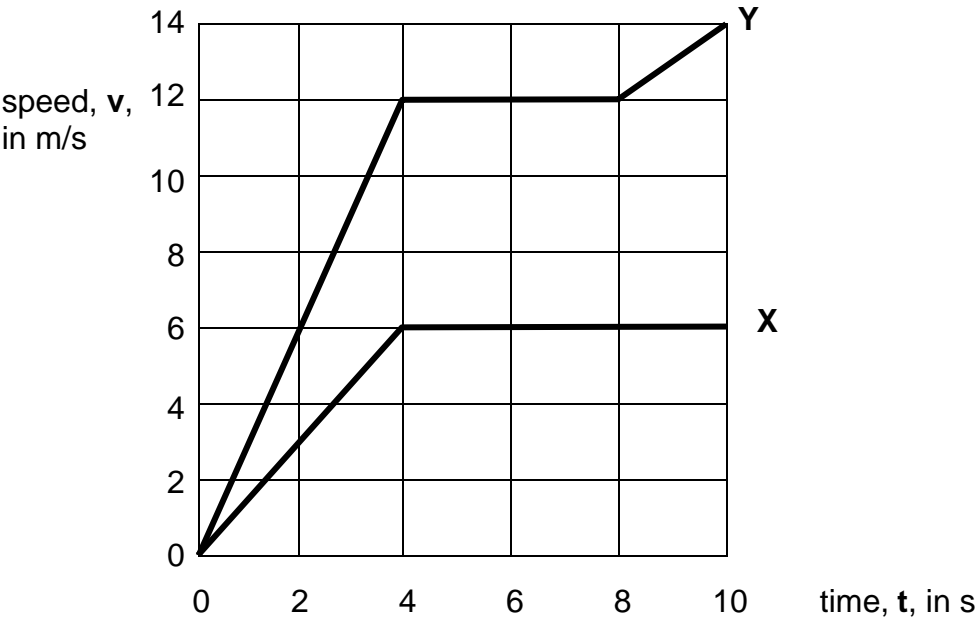
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Practice 10

Section A (45 marks)



Answer ALL the questions in the spaces provided.

1. The graph below shows how the speed, v , of 2 athletes **X** and **Y** varies with time, t , during a race.



- (a) Both the athletes started the race with acceleration. Explain how this is shown in the graph above. [1]

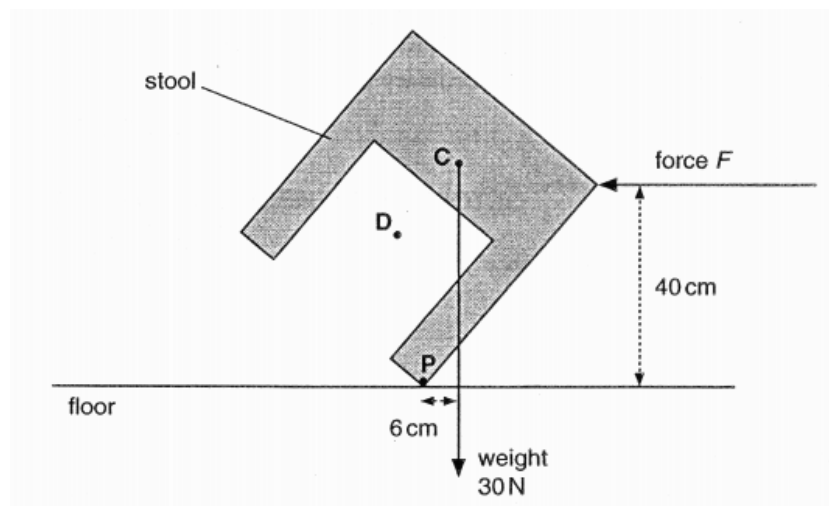
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- (b) Calculate the acceleration of both **X** and **Y** at 4 s. Hence compare which athlete has a greater acceleration before they reach constant speed. [3]

- (c) Athlete **Y** finishes the race in a time of 10 s. How far was athlete **X** from the finishing line at 10 s? [3]

2. Diagram below shows a 4-legged stool as viewed from the side.



- (a) A horizontal force **F** keeps the stool balanced. The weight of the stool is 30 N and acting as shown.
- (i) What is the value of the force **F** needed to keep the stool balanced? [2]

(ii) If the force F is removed, which way will the stool fall? [1]

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(iii) If the centre of gravity is at D and the same horizontal force F is used, explain why the force F does not help to keep the stool balance. [2]

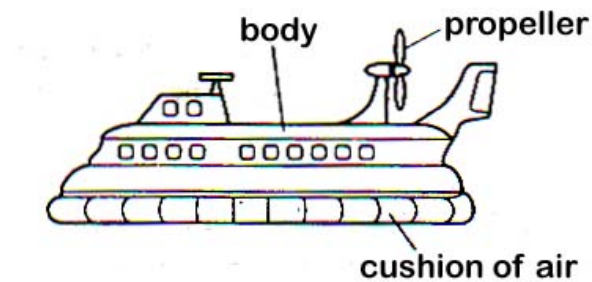
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(b) If each of the 4 legs has a base area of 16 cm^2 , calculate the pressure exerted by the chair when a person of 80 kg sits on it. (Take the weight of 1 kg to be 10 N) [2]

3. A hovercraft moves on a cushion of air which is trapped underneath it, as shown in diagram below. The trapped air reduces friction.



- (a) The hovercraft starts from rest and, as it starts, the propeller produces a forward force F of 22 000 N. The mass of the hovercraft is 25 000 kg. Calculate the initial acceleration of the hovercraft. You may assume there is no friction. [2]
- (b) Some time later, the hovercraft reaches a steady speed, even though the force F is unchanged. Suggest, in terms of the forces acting on the hovercraft, why the speed is now constant. [2]

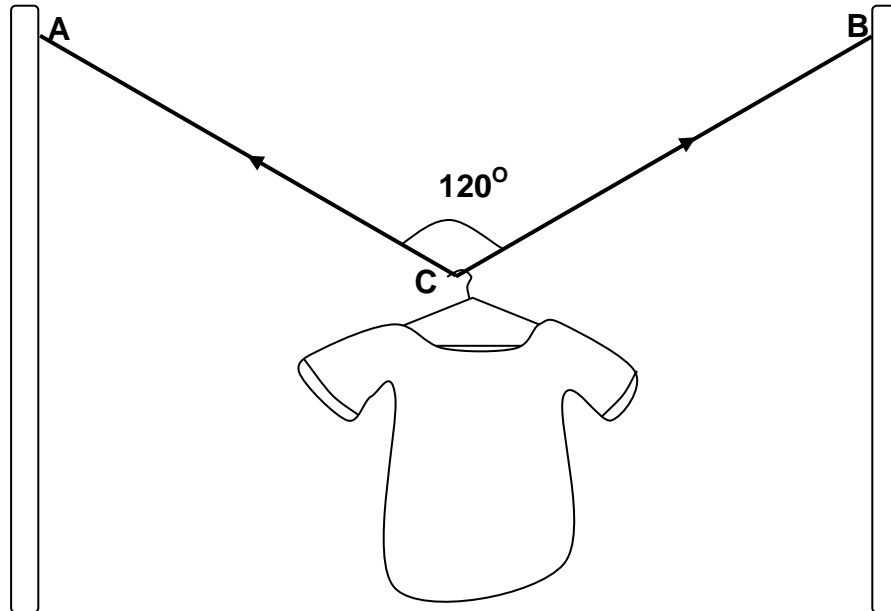
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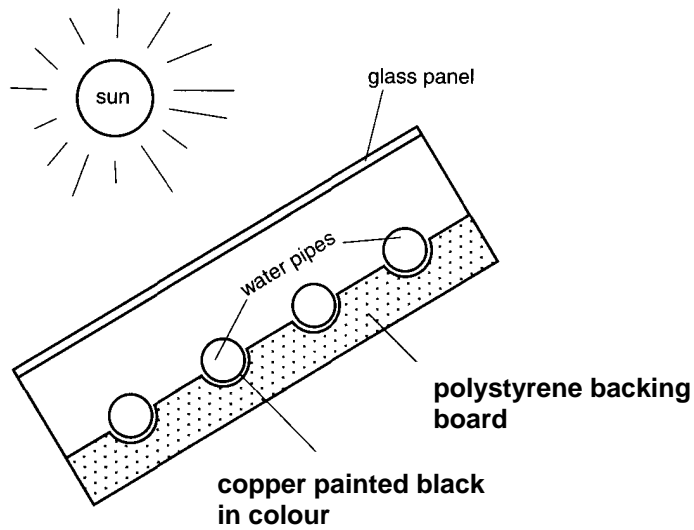
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4. A light rope is fixed at two poles with the ends **A** and **B** at the same level. A T-shirt is hung at the midpoint **C** of the rope. The rope depresses such that the angle **ACB** is 120° and the ropes have a tension of 20 N. Draw a scale diagram to determine the resultant force that is exerted onto the T-shirt. [3]



5. The following diagram shows the cross-section of a solar panel.



- (a) Explain why the water pipes are usually made of copper and painted black.[2]

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- (b) What is the purpose of the polystyrene backing board? [1]

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.....

- (c) On a hot day, such a solar panel is able to provide 300 W of power. Calculate the cost of using this to heat up water for 8 hours at a electrical cost of 5 cents per kWh. [2]

6. A thin convex lens is placed in the sunlight in the position as shown below. A match stick is placed below the lens and is lighted after a while in a certain position. What is this special position and explain why the match gets lighted up? Illustrate your explanation with rays of light drawn on the diagram below. [4]

sunlight



.....

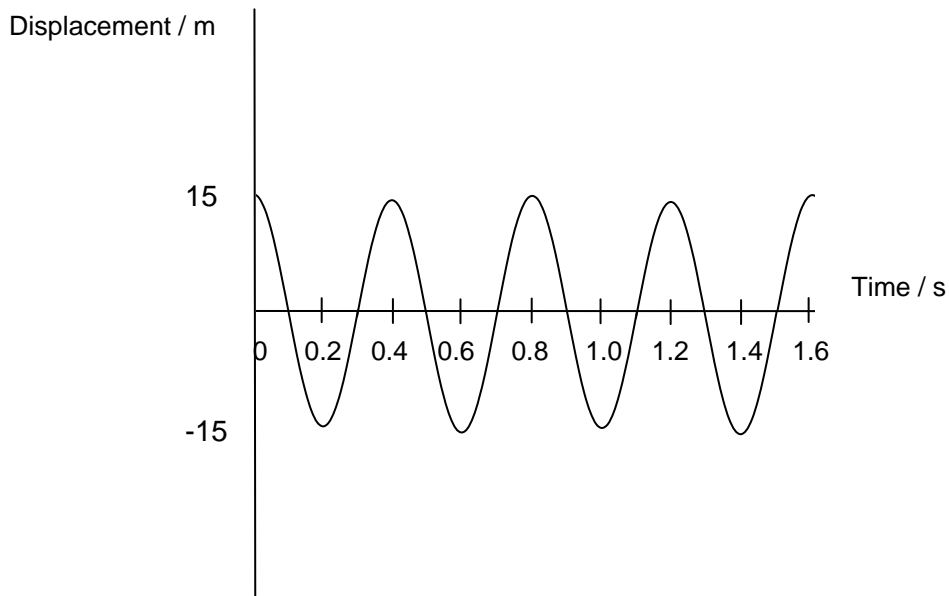
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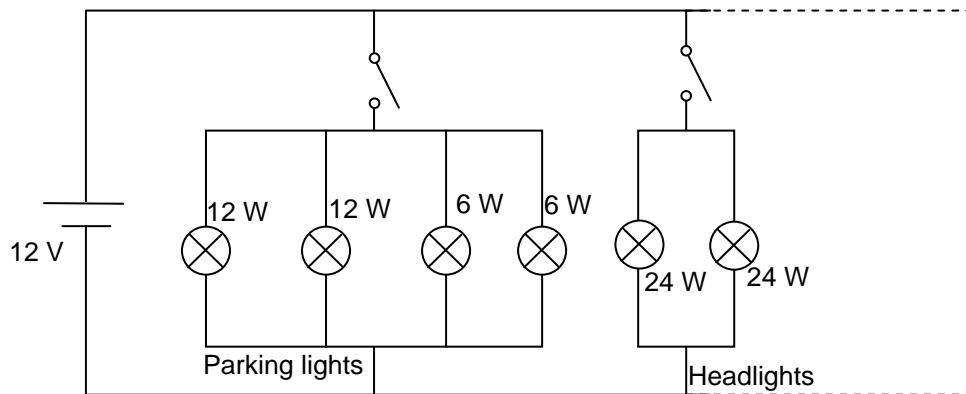
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7. Sam blows a particular note using his flute and produces a sound with waveform of a certain pitch and loudness as shown below.



- (a) What is the frequency of the sound being produced? [1]
- (b) Assume that the speed of the sound is 330 ms^{-1} , calculate the wavelength of the sound being produced. [2]
- (c) Later, Sam blows his flute two times as loud as before with a lower pitch note that is one-quarter of the original frequency, draw the new waveform on the same diagram above. [2]

8. Diagram below shows a simple lighting circuit commonly used in cars.



- (a) Are the parking lights circuit and the headlights circuit connected in parallel or series? [1]

.....

- (b) Calculate the total current flowing out from the 12 V d.c. source for the 2 circuits. [2]

- (c) If one of the bulbs from the parking lights circuit fuses, will the brightness of the other bulbs be affected? Explain. [2]

.....

.....

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9. The diagram shows the arrangement of a magnetic catch on a wooden door.



- (a) Describe what takes place as the magnet in the door approaches the soft iron in the frame. [2]

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.....

.....

- (b) Why is soft iron used rather than copper? [1]

.....

.....

- (c) Describe briefly how you would test if the set at the wooden door or that at the wooden frame is a magnet. [2]

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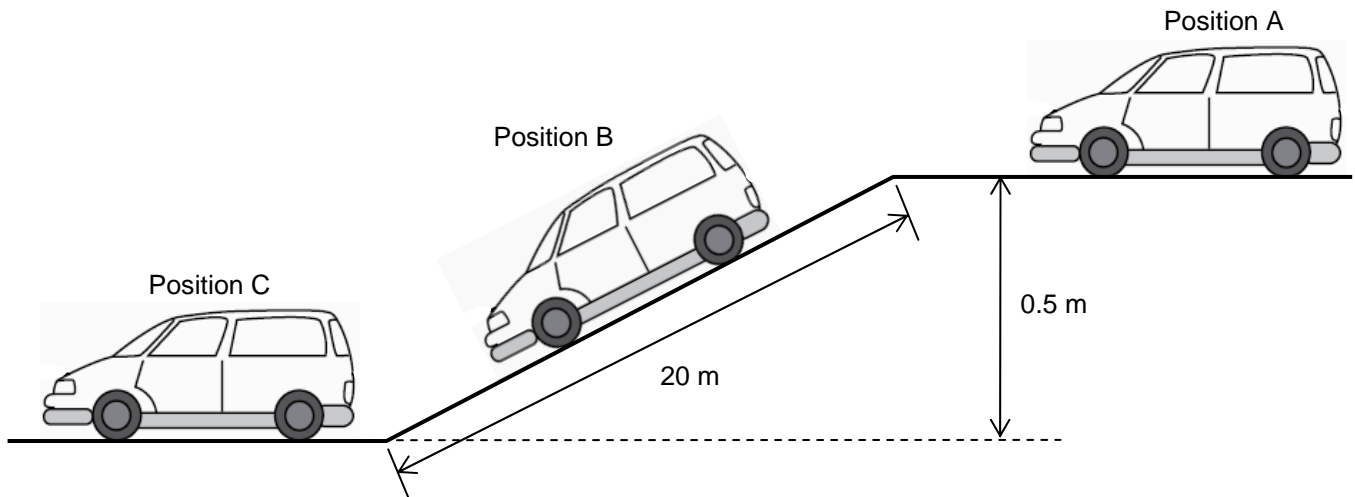
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Section B (20 marks)

Answer any **TWO** questions.

Write your answers on the lined pages provided and, if necessary, continue on separate answer paper.

10. A car of mass 600 kg was moving at a cruising speed of 15 ms^{-1} along a straight level road. It then travelled down a slope as shown in the diagram below and continued moving at the end of the slope.

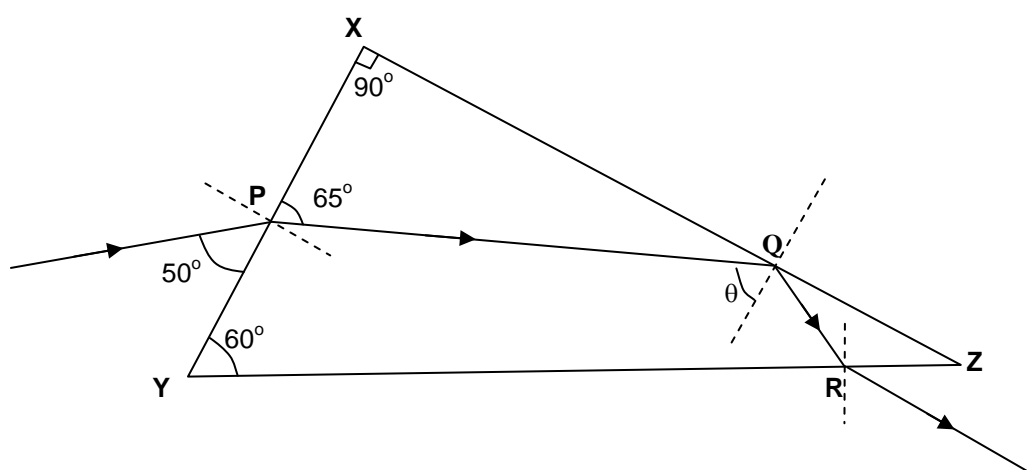


- (a) On the diagram above, where the car was moving down the slope (**Position B**), draw labelled arrows to show **ALL** the forces acting on the car [3]
- (b) Calculate the maximum energy the car had at **Position A**, just before it travelled down the slope. Take the value of g to be 10 m s^{-2} [2]
- (c) Find the maximum speed of the car when it reached the bottom of the slope, (**Position C**) assuming that the slope is frictionless. [2]
- (d) If the average force of friction on the slope is 200 N,
(i) calculate the work done by the car against friction as it moves down the slope. [1]
(ii) what would then be the speed of the car at **Position C**? [2]

- 11(a) Explain what is meant by critical angle. Diagram below shows a container of water. Draw a ray of light in the diagram below to illustrate the meaning of critical angle. [3]



- (b) A blue light ray incident at **XY** gets refracted into the glass prism **XYZ** as shown in the diagram below. (Not drawn to scale)



- By using the necessary given angles, calculate the refractive index of the glass prism. [2]
- Calculate the critical angle of the glass. [2]
- Calculate the angle θ at the point Q. [1]
- Explain why the light ray does not refract out of the glass prism at **Q** while it does at **R**. [2]

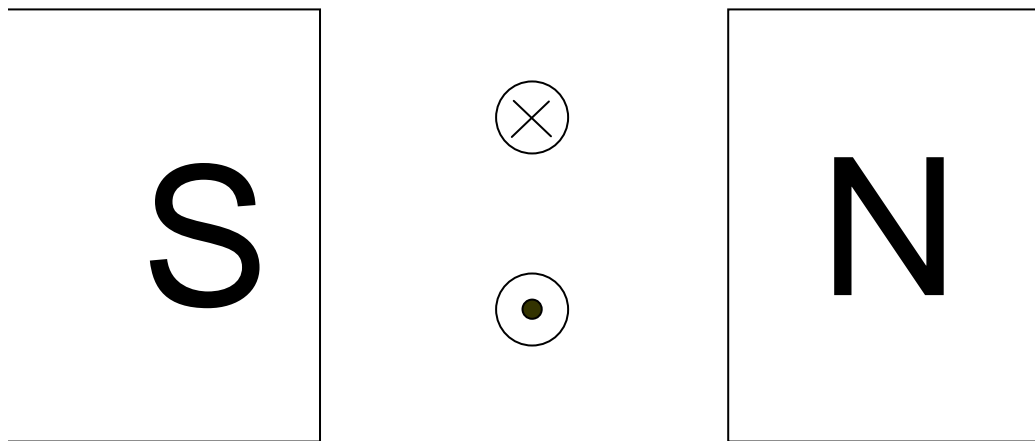
12. A piece of straight wire is connected to a direct current supply.
- (a) Complete diagram below by drawing the magnetic field produced by this wire with direct current flowing into the paper. [2]



- (b) The above straight wire is brought near another identical wire that carries a direct current flowing in the opposite direction as compared to the first wire. Draw the combined magnetic field of these two straight wires in diagram below. [2]



- (c) These two straight wires are then placed in between a pair of magnets with opposite poles.
- (i) Draw the combined magnetic field of this in the diagram below. [2]
- (ii) Indicate the direction of force (labelled as ***F***) experienced by each wire on the diagram. [1]
- (iii) Explain why there is a force on each wire. [1]
- (iv) Suggest 2 ways how this force can be made stronger. [2]



A series of horizontal dotted lines spanning the width of the page, intended as a guide for handwriting practice.

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.

***** End Of Paper 2 *****

Marking Scheme

Section A (45 marks)

Answer **ALL** the questions in the spaces provided.

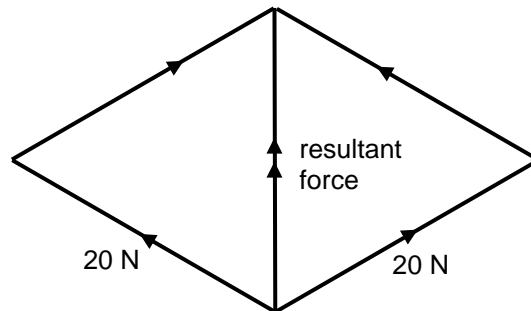
- 1(a) The graph at the beginning of the race shows a positive gradient graph. [1]
- (b) For Y: $a = \frac{v-u}{t} = \frac{12-0}{4} = 3 \text{ ms}^{-2}$ [1]
For X: $a = \frac{v-u}{t} = \frac{6-0}{4} = 1.5 \text{ ms}^{-2}$ [1]
- Y has a greater acceleration than X. [1]
- (c) Distance travelled by Y in 10 s
 $= (\frac{1}{2} \times 4 \times 12) + (12 \times 4) + (\frac{1}{2} (12+14) 2) = 98 \text{ m}$ [1]
- Distance travelled by X in 10 s
 $= \frac{1}{2} (6 + 10) 6 = 48 \text{ m}$ [1]
- X is $98 - 48 = 50 \text{ m}$ from the finishing line. [1]
- 2(a)(i) $F \times 40 = 30 \times 6$ [1]
 $F = 4.5 \text{ N}$ [1]
- (ii) Clockwise; (to its side) [1]
- (iii) Because **both the weight and F will give anti-clockwise moments**
and there is **no clockwise moment** to keep the stool balance. [2]
- (b) Pressure = $\frac{\text{Force}}{\text{Area}} = \frac{(80 \times 10) + 30}{16 \times 4}$ [1]
 $= 13.0 \text{ Ncm}^{-2}$ [1]
- OR $130\,000 \text{ Nm}^{-2}$
- 3(a) $F = ma$
 $a = \frac{F}{m} = \frac{22000}{25000}$ [1]
 $= 0.88 \text{ ms}^{-2}$ [1]
- (b) The speed of the hovercraft is constant as the **resultant force is zero**. This is because as the hovercraft moves there is increasing air resistance until

such that **the forward force is equal to the air resistance**, it reaches a steady speed. [2]

4. Scale: 1 cm : 5 N
Resultant force = 20 N (Range: 18 N to 22 N) [1]

Correct forces drawn (angle and magnitude) [1]

Correct resultant force identified on diagram [1]



- 5(a) Copper is a good conductor of heat and black is a good absorber of heat. Hence heat will be transferred to the water easily. [2]

- (b) To minimise heat loss from the water by conduction. [1]

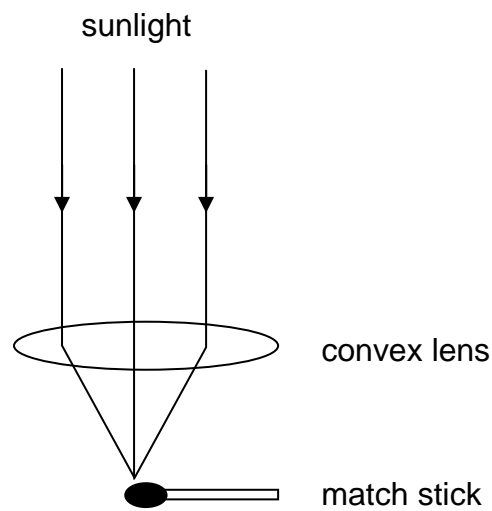
- (c) Energy used = $\frac{300}{1000} \times 8 = 2.4 \text{ kWh}$ [1]

Cost = $2.4 \times 5 = 12 \text{ cents}$ [1]

6. The match stick is placed at the focal point of the lens. [1]
The convex lens will focus the parallel beam of light from the sun onto the match stick. The heat from the focused light is high enough to light up the match stick. [2]

Correct parallel beam passing through the lens

[1]



7(a) *Period = 0.4 s*

$$\text{Frequency} = \frac{1}{\text{period}} = \frac{1}{0.4} = 2.5 \text{ Hz}$$

[1]

(b) $v = f\lambda$

$$330 = 2.5 \times \lambda$$

$$\lambda = 132 \text{ m}$$

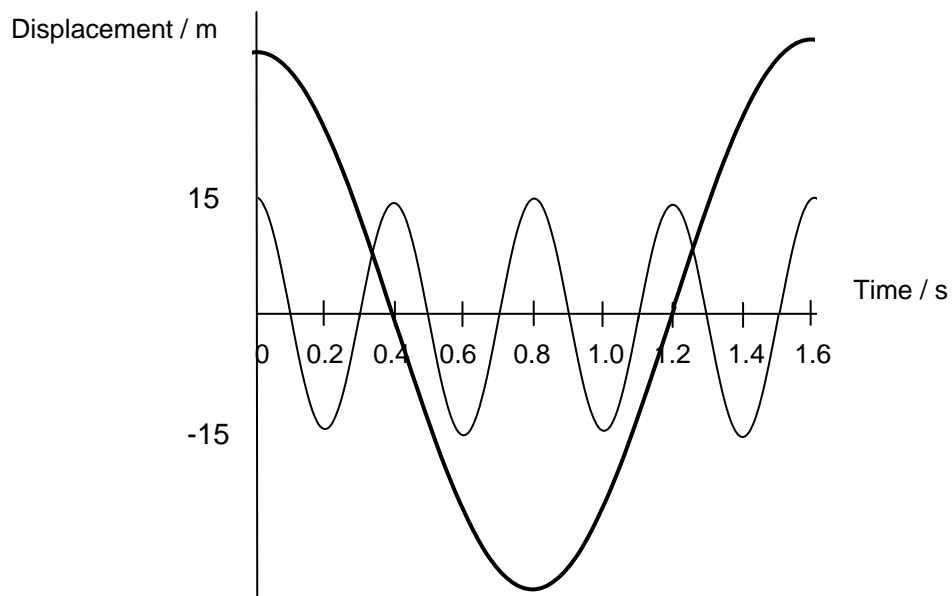
[1]

[1]

(c) *Correct amplitude*
Correct frequency

[1]

[1]



8(a) Parallel [1]

(b) Total power = $12 + 12 + 6 + 6 + 24 + 24 = 84 \text{ W}$ [1]

$$\text{Total current} = \frac{\text{total power}}{\text{total voltage}} = \frac{84}{12} = 7 \text{ A} \quad [1]$$

$$\text{OR Total current} = \frac{12}{12} + \frac{12}{12} + \frac{6}{12} + \frac{6}{12} + \frac{24}{12} + \frac{24}{12} \quad [1]$$

$$= 7 \text{ A} \quad [1]$$

(c) No. [1]
The other bulbs will remain just as bright because the bulbs are connected in parallel and the voltage for each bulb is the same. [1]

9(a) As the magnet approaches the soft iron, it **induces magnetism in the soft iron** and the soft iron is **attracted by the magnet**. [2]

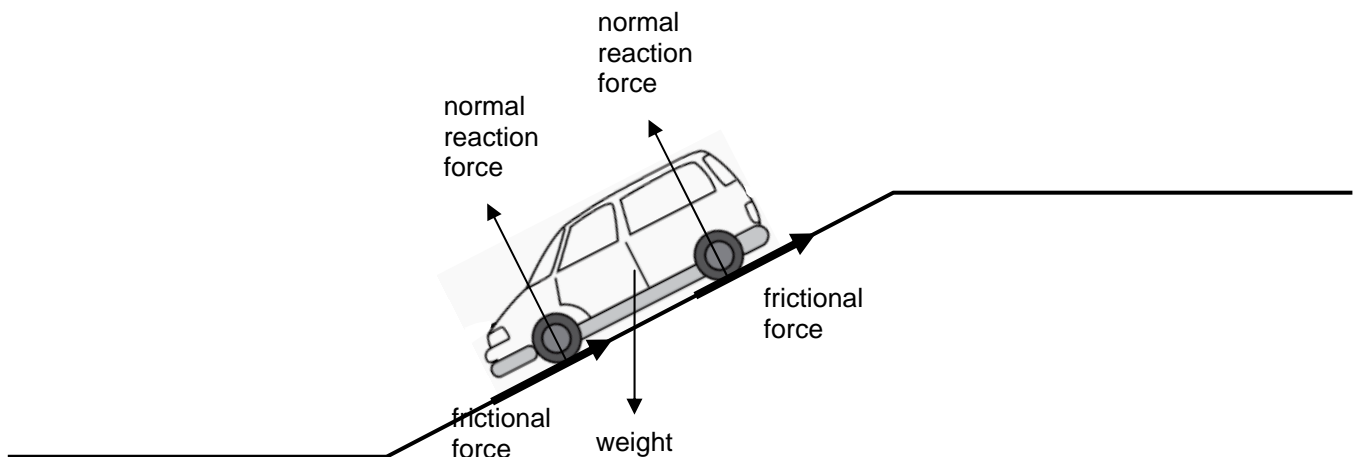
(b) Copper is **not a magnetic material** and so it will not be attracted by the magnet. [1]

(c) Bring another magnet close to each of the set. [1]
If there is any repulsion the set is a magnet. [1]

Section B (20 marks)

Answer any **TWO** questions.

10(a) Each type of force carries 1 mark each. [3]
(Normal reaction force and frictional force should be a pair to earn the 1 mark)
Deduct 1 overall mark if unlabelled or wrongly labelled.



(b) Maximum energy = K.E. + P.E. = $\frac{1}{2} mv^2 + mgh$

$$= (\frac{1}{2} \times 600 \times 15 \times 15) + (600 \times 10 \times 0.5) \quad [1]$$

$$= 67500 + 3000 = 70500 \text{ J} \quad [1]$$

(c) K.E. at bottom = Maximum energy at top

$$\frac{1}{2} mv^2 = 70500 \text{ J}$$

$$\frac{1}{2} \times 600 \times v^2 = 70500 \text{ J} \quad [1]$$

$$v = \sqrt{(70500 \times 2)/600} = \sqrt{235} = 15.3 \text{ m/s} \quad [1]$$

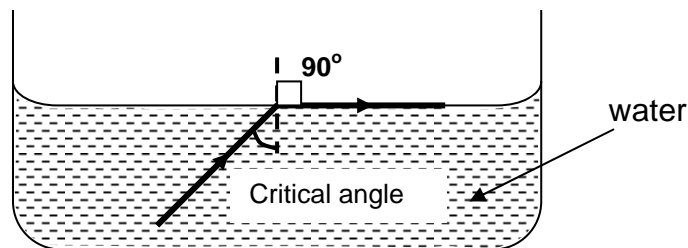
(d)(i) W.D. = $F \times d = 200 \times 20 = 4000 \text{ J}$ [1]

(ii) $\frac{1}{2} mv^2 = 70500 - 4000 \text{ J}$

$$\frac{1}{2} \times 600 \times v^2 = 66500 \text{ J} \quad [1]$$

$$v = \sqrt{(66500 \times 2)/600} = \sqrt{222} = 14.9 \text{ m/s} \quad [1]$$

11(a) Critical angle is the **angle of incidence** such that the ray of light travels from **denser to less dense** medium and the **angle of refraction is 90°** . [2]



Correct illustration with clear indication of critical angle [1]

(b)(i) $n = \frac{\sin(90 - 50)}{\sin(90 - 65)}$ [1]

$$= 1.52 \quad [1]$$

(ii) $\sin c = \frac{1}{n} = \frac{1}{1.52} = 0.658$ [1]

$$c = 41.1^\circ \quad [1]$$

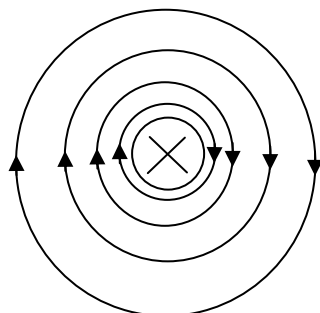
(iii) $\theta = 65^\circ$ [1]

(iv) At **Q**, the light has an angle of incidence (65°) **greater than the critical angle** (41°) and so total internal reflection occurs while at **R** the light has an angle of incidence **less than the critical angle** and so it is refracted out of the glass prism. [2]

- 12(a) Correct concentric circles drawn with wider gap further from centre
Correct direction of magnetic field lines

[1]

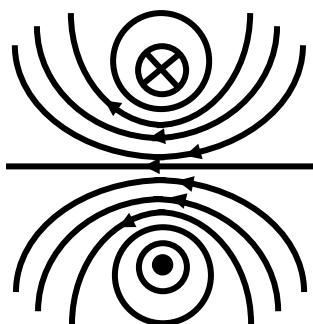
[1]



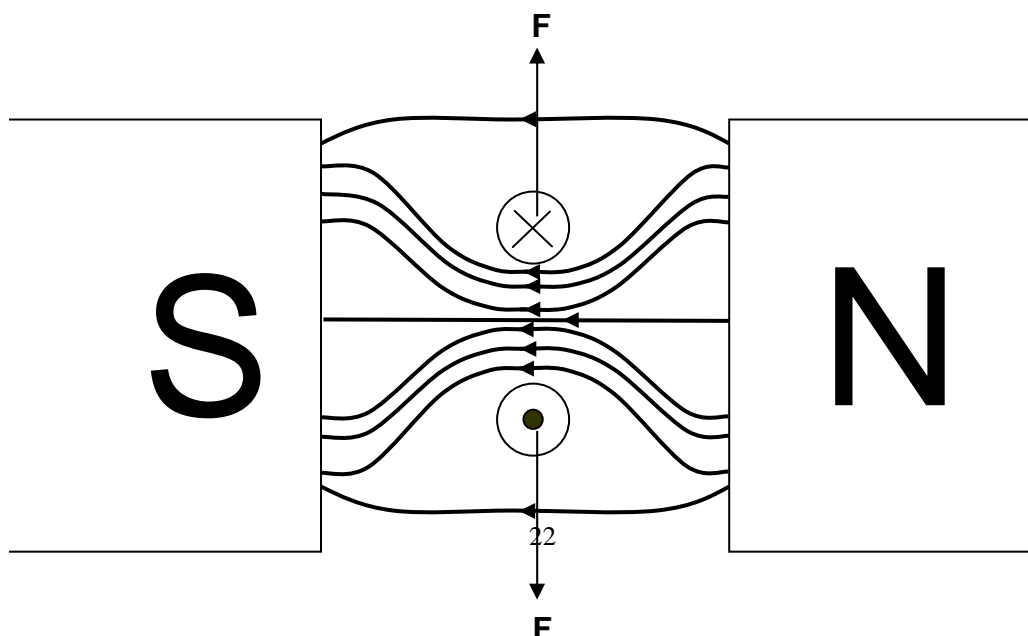
- (b) Correct magnetic field in between the two wires
Correct direction of magnetic field lines

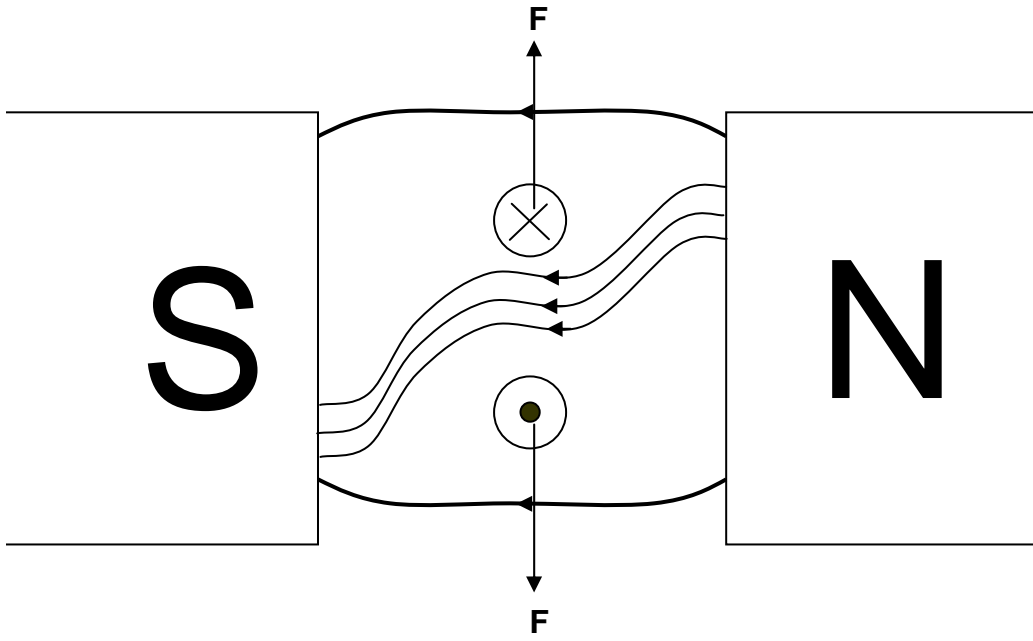
[1]

[1]



- (c)(i) Correct combined magnetic field
Correct direction of magnetic field lines [1]
[1]
(ii) Correct direction of force [1]
(iii) The combined magnetic fields of the wires and the magnets will give rise to the forces shown in the diagram. There is **stronger combined magnetic field** in between the wires. [1]
(iv) Greater current in the wires; stronger magnets used; [2]





OR

